MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

BEM1014 –MATHEMATICS

(All sections / Groups)

15 OCTOBER 2015
2.30 p.m - 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **6 pages** including cover page and mathematical formulas with **4 Questions** only.

2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.

3. The candidate is allowed to use scientific calculators that are permitted to be used in the examination.

Question 1 (13 marks)

(a) Solve the quadratic-form equation $\frac{1}{x^4} - \frac{9}{x^2} + 8 = 0$.

[3 marks]

(b) Solve $\sqrt{x} - \sqrt{3x+1} + 1 = 0$.

[2 marks]

(c) Solve the inequality equation $|1 - 3x| > 2$.

[2 marks]

(d) Find an equation of a line passing through (4, -5) and perpendicular to the line $3y = -\frac{2x}{5} + 3$.

[2 marks]

(e) The demand function for a production line of computer is $p = 2400 - 6q$, where p is the price per unit when q units are demanded by consumers. Find the level of production that will maximize the manufacturer's total revenue, and determine this revenue (revenue, $r = pq$).

[4 marks]

Continued...

Question 2 (13 marks)

(a) A research book has a unit selling price of \$20 and a unit cost of \$15. If fixed costs are \$600,000, determine the least number of units that must be sold for the company to have a profit (*Profit = Total Revenue – Total Cost*).

[3 marks]

(b) *Maximize* the profit function $P = 5x + 7y$

subject to the constraints

$$\begin{aligned} 2x + 3y &\leq 45 \\ x - 3y &\geq 2 \\ x, y &\geq 0 \end{aligned}$$

Sketch the inequality region.

[4 marks]

(c) *Minimize* the cost function $C = 3x + 2y$

subject to the constraints

$$\begin{aligned} 2x + y &\geq 5 \\ 3x + y &\geq 4 \\ x + 2y &\geq 3 \\ x, y &\geq 0 \end{aligned}$$

Sketch the inequality region.

[6 marks]

Continued...

Question 3 (12 marks)

(a) To what sum will \$2000 amount after **eight years** if invested at a **6% effective rate** for the first four years and at **6% compounded semi-annually** thereafter?

[3 marks]

(b) A debt of **\$750 due in 10 years** and **\$250 due in 12 years** is to be repaid by a **single payment now**. Find how much the payment is if an interest rate of **8% compounded quarterly** is assumed.

[4 marks]

(c) A trust fund is being set up by a single payment so that at the **end of 30 years** there will be \$50,000 in the fund. If interest is compounded continuously at an **annual rate of 6%**, how much money should be paid into the fund initially?

[2 marks]

(d) In 10 years, a \$40,000 machine will have a **salvage value of \$4000**. A new machine at that time is expected to sell for \$52,000. In order to provide funds for the difference between the replacement cost and the salvage value, a sinking fund is set up into which equal payments are placed at the end of each year. If the fund earns **7% compounded annually**, how much should each payment be?

[3 marks]

Continued...

Question 4 (12 marks)

(a) Find an equation of the tangent line to the following curve at the indicated point:

$$y = (x + 3)^3; (-1,8)$$

[2 marks]

(b) Use the chain rule to differentiate $y = 4x^2\sqrt{5x + 1}$.

[2 marks]

(c) If $f(x, y) = x^3y^2 + x^2y - x^2y^2$, find $f_{xxy}(2,3)$ and $f_{xyx}(2,3)$.

[3 marks]

(d) Evaluate the definite integrals

$$\int_2^3 (x + 2)^3\, dx$$

$$\int_2^{e+1} \frac{1}{x - 1} dx$$

[2 marks]

(e) Find the area of the region bounded by $2y = 4x - x^2$ and $2y = x - 4$.

[3 marks]

End of Page.

Course: Mathematics
Code: BEM 1014

Summary of Principal Formulas and Terms

Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)
(ii) Accumulated amount, $A = P(1 + rt)$

Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$
(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

Future Value of an Annuity

$S = R\left[\frac{(1+i)^n - 1}{i}\right]$ (S = future value of ordinary annuity of n payments of R dollars periodic payment)

Present Value of an Annuity

$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$ (P = present value of ordinary annuity of n payments of R dollars periodic payment)

Amortization Formula

$R = \frac{Pi}{1-(1+i)^{-n}}$ (R = periodic payment on a loan of P dollars to be amortized over n periods)

Sinking Fund Formula

$R = \frac{Si}{(1+i)^n - 1}$ (R = periodic payment required to accumulate S dollars over n periods)